

ART. XIX.—*The Spleen a permanent Placenta: the Placenta a temporary Spleen.*
By JOHN JACKSON, Member of the Royal College of Surgeons. 8vo. pp. 32.
London, 1843.

THERE are many serious obstacles to acquiring a correct knowledge of the proper offices of the spleen and placenta, and which to a certain extent, at least, are probably insurmountable. The anatomical structure of these organs affords us not the least clue in the investigation of their functions, and the few imperfect experiments that have been attempted for the purpose of solving this interesting problem in physiology have been without any satisfactory results. No one of the various theories that have been advanced in relation to the subject, can be viewed in any other light than as more or less plausible conjectures; the whole of them being unsupported by positive evidence. These remarks are particularly applicable to the functions of the spleen. The idea originally suggested by Dr. Rush, that it acts the part of a diverticulum or reservoir, by which the portal system is relieved from undue distension, under a variety of circumstances of frequent occurrence during health, is now very generally adopted by physiologists; and yet, it must be admitted, that this view of the office of the spleen is, to say the least of it, very problematical. It is a curious circumstance that from no one of the several pathological conditions of the organ has the least degree of light been thrown upon its proper function, while, in the experiments performed upon the lower animals, even when the organ has been entirely removed, no perceptible interruption to any of the vital functions was discovered to take place. It has hence been inferred that whatever may be the office it performs, it is not one in any way essential to life.

In the essay before us, Dr. Jackson assumes for the spleen, however, a much higher office than it has hitherto been generally supposed to fulfil; that, namely, of a true heart, for effecting the circulation of the blood of the portal system through the liver, in the same manner as the right side of the central organ circulates the venous blood through the lungs. In other words, that the spleno-hepatic vein, of the minute ramifications of which the spleen is composed, performs for the liver, the duties of auricle, ventricle and artery; it being the recipient cavity and propulsive agent of the hepatic vascular system, as well as the vessel by which the blood of the portal system, after it has undergone the changes produced in it by the action of the liver, is again transmitted to the right cavities of the heart.

Startling as the first enunciation of this hypothesis will appear to most of our readers, the author has adduced in its support a number of very ingenious and plausible arguments, and although we are far from admitting that he has succeeded in fully establishing its accuracy, it is nevertheless one deserving of a close and candid examination, and may, probably, by directing attention to the subject, lead to the true explanation of the physiology of the spleen.

Dr. Jackson maintains, that the portal circulation constitutes a distinct, perfect, and independent system. Receiving, through the spleno-hepatic vein, "not only all the blood which is supplied to the digestive organs by the celiac and mesenteric arteries, but also all the fluids which are taken into the stomach, every ounce of which must enter the spleno-hepatic vein, and pass through the three systems of the circulation in their natural order of hepatic, pulmonary, and general;" the liver must, he conceives, be altogether independent, for the force by which the blood thus received by it, is circulated through its substance and subsequently transmitted to the heart, of the contraction of the left ventricle:—"If," he remarks, "the hepatic system were not an independent system, or in other words could not propel its own blood through its own vessels, the blood would never get through it at all;" the left ventricle being no more able to "propel the blood through the hepatic system, than the spleno-hepatic vein can propel it through the pulmonary system, or the right ventricle through the general system."

As this position constitutes the very foundation upon which the views of Dr.

Jackson as to the uses of the spleen are based, a general statement of his arguments in proof of it may not be uninteresting.

"That," observes the author, "the hepatic system is an independent system, and not a mere part or dependency of the general system, is indicated, first, by the portal trunk dividing into branches, the subdivisions of which ultimately become capillaries, just as the pulmonary artery and aorta divide into branches which ultimately become capillaries; secondly, by the circulation of the portal plexuses being the *second* system of capillaries, through which blood, propelled by the left ventricle through the cœliac and mesenteric arteries, and their branches, has to pass before it can re-enter the right auricle. But there is no reason why the hepatic system should be regarded as a mere part or dependency of the general system, or rather a part of a part of the general system, which it is if not a perfect and independent system in itself. Nor can any reason be given why the vessels which proceed to and from the liver should belong to a less perfect and independent system than those which proceed to and from the lungs: nor why the blood which has to be propelled *vertically* through the liver, is not in need of an appropriate agent for its propulsion, while the blood which is propelled *horizontally* through the lungs, requires a very powerful one, the right ventricle."

It is further remarked, that as the only course for the fluids received by the stomach, is through the gastric and duodenal veins into the *spleno-hepatic vein*, "it follows, therefore, that not only is the portal blood a more or less diluted blood, but that much more diluted blood enters the heart by the hepatic veins, than there is arterial blood supplied to the digestive organs by the cœliac and mesenteric arteries."—This Dr. Jackson urges as an additional argument to prove "that the left ventricle is totally incapable of propelling the portal blood through the hepatic system;" and, he remarks, "a more positive and convincing proof" could not be adduced; "for it shows, that if the left ventricle were the agent in the propulsion of the portal blood, it would be necessary first to be able, by propelling a certain quantity of blood, say one ounce, into the cœliac and mesenteric arteries, to drive a greater quantity, say ten drachms, through the three divisions of the hepatic system into the right auricle; that is, through the sub-hepatic veins, the portal plexuses, and supra-hepatic veins. Now this is plainly as impossible, as for a power to overcome a resistance greater than itself; and therefore, he concludes, nothing can be more certain than that the left ventricle is not the agent in the propulsion of the portal blood."

The opinion that the right auricle, in consequence of the tendency to a vacuum produced by its dilatation or expansion, has the power of assisting the passage of the blood through the liver, by pumping it, as it were, out of the hepatic veins, the author considers to be entirely unfounded. "The fitting objection," he observes, "to this sagacious opinion is, that if expansion of the right auricle is capable of pumping blood through the liver which is *below* the heart, expansion of the left auricle ought to be able to pump blood through the lungs, which are placed on *each side* the heart; and that if no peculiar agent is needed to propel the blood through the liver, neither ought any to be required to propel it through the lungs, and that the right ventricle must therefore be superfluous."

This mode of reasoning strikes us, however, as being far more specious than conclusive.

That the motion of the diaphragm and abdominal muscles does not render any important assistance in the propulsion of the blood through the liver, Dr. Jackson considers to be shown by the circumstance of the blood being propelled through the liver before birth, as well as subsequent to the establishment of respiration.

The author considering it to be proved, that neither the left ventricle, nor the right auricle, nor the movements of respiration are sufficient to propel the blood through the hepatic system; proceeds to show that this office is performed by the spleen, or more correctly, that the circulation of the portal blood and the other fluids which it receives from the splenic artery, gastric, duodenal, and mesenteric veins, through the three divisions of the hepatic system is effected.

"The spleno-hepatic vein may be," he remarks, "compared to a tree; for like a

tree, it is composed of roots, trunk, and branches. The *spleen* is the *roots*; the *splenic vein*, and its continuation, the *portal vein*, are the *trunk*; and the *ramifications of the portal vein* to their terminations in the *portal plexuses*, are the *branches*.

"The *spleen* is composed of the branches of the splenic artery, their capillary terminations, and of the roots of the spleno-hepatic vein; but chiefly and essentially of the latter, which are remarkable for their large size, tenuity and distensibility. The trunk and branches of the spleno-hepatic vein, as well as the roots or spleen, are also highly distensible. The roots or spleen, are contained in an elastic capsule; and the branches are surrounded by sheaths of loose cellular membrane, (prolongations from Glisson's capsule,) which accompany the branches through the portal canals, even to the terminations of the former in the portal plexuses. The distensibility of the whole vein, roots, trunk, and branches, the roots being surrounded by an elastic capsule, and the branches by loose cellular sheaths, are sure indications that the degree of distension of the spleno-hepatic vein, or the quantity of portal blood it contains at different times, is subject to great variation. If the spleen were surrounded by an '*aponeurotic*,' and therefore unyielding membrane, it could not suffer distension; and if the branches of the spleno-hepatic vein in the liver were like the supra-hepatic veins, simple canals, they could not suffer distension: and under those circumstances the vein, at least the roots and branches, would contain at all times the same quantity of blood; and could not then perform those important duties which we are endeavouring to show that it fulfils. But Glisson's capsule and the splenic capsule are proofs that it does contain a varying quantity of blood; for they are obviously provisions to allow of its distension; and could be of no use if the quantity of portal blood were always the same. It has indeed, been matter of actual observation with some physiologists, that the size of the spleen (or in other words, the degree of distension of the first portion or roots of the spleno-hepatic vein) varies very considerably at different times in the same animal; from which variation in the size or distension of the spleen, and because the organ consists chiefly of venous roots, Bérard justly remarked, that in '*texture and phenomena*' it closely resembles the penis."

After remarking that the degree of distension of any one of the three divisions of the spleno-hepatic vein is at all times proportionate to that of either of the other two—Dr. Jackson continues,—

"As the roots, trunk, and branches, of the spleno-hepatic vein are distensible, it follows, that they must also possess the power of contraction. The distension of the vein is produced by the in-pouring of blood from the splenic artery, gastric, duodenal, and mesenteric veins, and of fluids from the gastric and duodenal veins. When the vein is moderately distended, the addition of more blood and fluid would increase that distension, and could not by any possibility have the effect of diminishing it. How then could the degree of distension vary, if the vein were not contractile as well as distensible? To be sure it might go on varying by constantly increasing until some part or other of the vein gave way, when fatal hæmorrhage would be produced; but any diminution of the degree of distension could not take place if the vein were not contractile. It is no less certain, therefore, that the spleno-hepatic vein is contractile than that it is distensible. Its contractibility is a vital property; its distensibility a physical one. The distension of the vein is consequently passive, and its contraction active; when the distension has reached a certain point, contraction takes place; and the natural and necessary effect of that contraction is, what nothing else can accomplish, the propulsion of the portal blood through the three divisions of the hepatic system into the right auricle."

"The action of the spleno-hepatic vein is like that of the auricles and ventricles, intermittent; like them it suffers distension and then contracts; but as its distension is far slower and less frequent than theirs, so also is its contraction."

To establish the truth of the position here assumed, one of two things must also be true, either that the contraction of the different portions of the spleno-hepatic vein is of a peristaltic kind, or that the vein is supplied with valves opening towards the liver. Now we believe, that it is generally admitted by

anatomists that the portal veins are destitute of valves, and the author offers no evidence that their contraction takes place successively along their course.

"That the spleno-hepatic vein propels the portal blood through the hepatic system is further proved," Dr. Jackson argues, "by the much greater size of the spleen, relatively to the liver, in man than in quadrupeds. It is, perhaps, not overrating the weight of the spleen in man, to estimate it at about one-sixth of the weight of the liver; but in quadrupeds it is only one-twelfth, one-fourteenth or one-sixteenth. Owing to man walking on two legs, and quadrupeds on four, the axis of the trunk, and therefore, the direction of the vessels through the liver, are vertical in the former and horizontal in the latter; and as a greater power is needed to propel the portal blood vertically than horizontally, so does the spleno-hepatic vein of the man require a larger proportionate quantity of roots, or spleen, than the spleno-hepatic vein of the quadruped. If the relative size of the spleen to the liver were the same in quadrupeds as in man, the impetus which the contraction of the spleen would give to the portal blood would be too great; and the propulsion of the blood through the portal plexuses and hepatic veins into the right auricle, would be too rapidly effected. If, on the other hand, the relative size of the spleen to the liver were no greater in man than it is in quadrupeds, the impetus communicated to the portal blood by the contraction of the spleen would be too little; and its propulsion through the portal plexuses and hepatic veins would be too slowly and with too much difficulty effected. In quadrupeds the flow or passage of the blood through the liver, is but little influenced by gravitation; in man gravitation is, most commonly, directly opposed to it."

Dr. Jackson notices the objection that may be brought against his doctrine of the functions of the spleen, from the fact that the ablation of the organ in the inferior animals, has been unattended with any apparent interruption to the functions of life, and, also, from the instances upon record of the partial or even entire loss of the spleen in the human subject, without the health of the individuals being in the least affected. "How long they lived," he remarks, "with only a part of the spleen, or none at all; and whether they ultimately died of enteritis, or of hepatic disease, or of affections not produced by the accident, are matters upon which no information is afforded us. It is obvious why loss of the spleen is not fatal, nor productive of any serious immediate effects. It has been already stated, that the spleen is essentially only the roots of the spleno-hepatic vein, the trunk and branches of which vein, as well as the roots, possess the property of vital contractility. When the spleen is removed, the roots of the spleno-hepatic vein only are removed. The trunk and branches are left behind: and the loss of the roots is not followed by the loss of contractility in the trunk and branches. The gastric, duodenal, and mesenteric veins terminate, not in the roots of the spleno-hepatic vein, but in the trunk. The vein, therefore, serves the purpose of recipient cavity just as well after the spleen has been removed as before. It is impaired only as a propulsive agent; and all the effect which the removal of the spleen produces is, that the blood is propelled through the liver less perfectly and freely than before: but still that propulsion is effected, although slowly and with difficulty, by the trunk and branches."

The author, therefore, concludes, that "although the spleen is not an organ essential to life—although it is only a part of a vein—and although physiologists have been accustomed to treat it somewhat contemptuously—it is, nevertheless, entitled to some degree of consideration and respect; for be it remembered, the hepatic system is the first of the three systems comprised in the circulation of the blood; the spleno-hepatic vein performs in that system the triple function of auricle, ventricle, and artery; and the spleen is not only a part of the spleno-hepatic vein, but it is the very first part."

Thus far, in relation to Dr. Jackson's doctrine of the functions of the spleen and the leading arguments by which it is sustained—the remaining portion of his treatise is devoted to a consideration of the office of the placenta. The placenta, he maintains, is neither more nor less than a temporary spleen, rendered necessary by the peculiar circumstances of the intra-uterine life. In other

words, that in the fetal state it is the organ, or heart by which the blood, transmitted from the mother to the child in utero, is propelled through the umbilical vein and fetal liver.

"Doubts," he remarks, "may have been entertained by those who have fancied there is a direct communication, by means of capillaries, between the uterine and placental vessels, whether the maternal heart or the fetal heart propelled the blood from the placenta through the umbilical vein and fetal liver into the fetal auricles; but they who know that there is no such communication, and that the placenta is composed entirely of fetal vessels—and who are, therefore, perfectly assured that the motion of the blood along the umbilical vein is not produced by the vis-a-tergo of the maternal left ventricle—have never called in question the capabilities of the fetal ventricles; but have given the '*mighty vital organ*,' as the heart has been termed, full credit for carrying on the entire circulation before birth as well as after!"

"The following circumstances, however," Dr. J. conceives, "unquestionably prove that the fetal ventricles do not propel the blood from the placenta through the umbilical vein and fetal liver into the fetal auricles: First, the small size of the fetal heart as compared with the liver and placenta; secondly, the great length of the umbilical cord; thirdly, the great tortuosity of the umbilical arteries which render them much longer even than the veins; fourthly, the small calibre of those arteries compared with that of the vein; fifthly, the two capillary systems, one in the placenta, the other in the fetal liver; sixthly, the fact that more blood passes from the placenta through the umbilical vein to the fœtus, than from the fœtus through the umbilical arteries to the placenta—which is evidently the case, because the blood being the *matériel* of the fetal development and growth is constantly being deposited in all parts of the fetal system; and, lastly, because the blood does get propelled through the fetal liver when there is no heart, as is proved by the acardiac fœtuses."

"The hepatic system," Dr. J. remarks, "is a distinct, perfect, and independent system, before birth as well as after: and as the vein, of which the spleen is the root, performs *per se* in that system after birth, the triple function of recipient cavity, propulsive agent, and afferent vessel, so also does the vein, of which the placenta is the roots, perform *per se* the same triple function in the hepatic system before birth.

"Both the spleen and placenta are composed of arterial branches, their capillary terminations, and venous roots; but chiefly and essentially of venous roots, remarkable for their large size, tenuity, and distensibility, and also for their contractility.

"Before birth, the hepatic vascular system possesses *two spleens*; one intra-abdominal and permanent—the *spleen*; and one extra abdominal and temporary—the *placenta*."

Between these two organs there exist the following analogies and resemblances:

"1. The spleen is composed of arterial branches, and venous roots, with their intervening capillaries; and so also is the placenta. 2. The spleen is contained in an elastic capsule which sends prolongations through its interior. The placenta is also contained in an elastic capsule formed by the two layers of the decidua, and from the inner surface of which proceed prolongations analogous to those of the splenic capsule. 3. The circumference of the spleen is more or less lobulated or fissured; and so also is the circumference of the placenta. 4. The spleen receives very few and very small nerves. The placenta, it is believed, receives none. 5. The splenic artery is remarkable for its tortuosity. The umbilical arteries are even more tortuous than the splenic. 6. The spleen is connected with the liver by a vein, of which it (the spleen) is essentially the roots. The placenta is also connected with the liver by a vein, of which it (the placenta) is essentially the roots. 7. At the transverse fissure of the liver these two veins, the spleno-hepatic and umbilical, are connected together by a large short branch, the *ductus communicans*. 8. These two veins resemble each other, and differ from all other veins, by dividing and subdividing after the

manner of the arteries. 9. The branches of both terminate in the same system of capillaries, the portal plexuses. 10. The trunk and branches of the spleno-hepatic vein contain a diluted blood. The roots, as well as the trunk and branches of the umbilical vein also contained a diluted blood—the dilution of the latter is effected previous to its entering the placenta, by being deprived of its fibrine, which is deposited in the parietes of the uterus: and by this deposition the rapid growth and development of the uterus are produced, which take place during the period of gestation.”

In regard to the cause of the splenic and umbilical arteries being tortuous rather than straight, Dr. Jackson remarks, that, “the tortuosity of the umbilical arteries is evidently for the purpose of minimising the quantity of blood sent back to the placenta; for every drop over and above that required for the nutrition and growth of the placenta is sent on a bootless errand. The tortuosity of the splenic artery serves a similar purpose; it greatly impedes the flow of blood through that vessel, and thereby prevents any very considerable or undue quantity from passing through it into the spleno-hepatic vein; for as the splenic artery is, for reasons already given, a large vessel, a very great quantity of blood would necessarily pass through it if it were straight instead of tortuous. Judging from the extreme tortuosity both of the splenic and umbilical arteries, there can be but little doubt, that the quantity of blood which passes through them is very much less than we have long been accustomed to suppose.”

“The spleen and placenta, therefore,” observes Dr. J., “besides presenting a striking similarity in their external appearances, are of similar texture, and are connected with the same organ, *the liver*, by a vein of which each is the roots. The trunks of the two veins are connected with each other; the branches of both terminate in the same system of capillaries; and each vein contains a diluted blood. With such facts as these before our eyes, we cannot help inferring that the vein, of which the placenta is the roots, performs a very similar function, before birth, to that which the vein, of which the spleen is the roots, performs after birth. It has been shown that the spleno-hepatic vein performs, in the hepatic system, after birth, the triple function of recipient cavity or auricle, propulsive agent or ventricle, and afferent vessel or artery; and it is at once evident that the vein, of which the placenta is the roots, performs at least two parts out of three of that function before birth! It is the *recipient cavity*, for it receives blood from the uterine vessels (veins), and, also, a certain, though probably inconsiderable, quantity from the fœtus by the umbilical arteries, which commingles with the former in the roots of the umbilical vein. It is also the *afferent vessel*, for through it the blood passes into the liver; in which organ it divides and subdivides, and terminates in capillaries;—like the three other afferent vessels, the spleno-hepatic vein, pulmonary artery, and aorta. But is it also the *propulsive agent*? Is it owing to the vital contractility of the vein, of which the placenta is the roots, that the blood which exudes into these roots from the uterine veins, and also that which the fœtal heart sends into them through the umbilical arteries, is propelled a distance of some twenty or thirty inches, and then through the fœtal liver into the fœtal auricles? Undoubtedly it is. The fœtal heart cannot effect that propulsion, for reasons already given, and therefore the vein, of which the placenta is the roots, must.”—“To say that it is not contractile, merely because we do not see or hear it contract, is idle and frivolous. It *must be* contractile, and, in addition to that necessity, its close resemblances, in so many particulars, to the spleno-hepatic vein plainly shows that it is.”

“Before birth, the liver is remarkably large, and the spleen is remarkably small. The latter organ, therefore, bears a much less proportion to the former before birth than it does some time after; for after birth, the liver, for a short time, actually diminishes in size; but on the other hand, the spleen, until it attains its full development, slowly but constantly increases; so that the splenic artery after birth becomes larger than the hepatic, although before birth it is smaller. The reason the spleen is so small before birth is obvious: it is because there then exists another spleen, an extra abdominal and temporary one, *the*

placenta. The fœtal liver does not require *two* spleens to propel the blood through it; and therefore the permanent spleen remains very small until after birth; at which period it is, and not before, that its real function commences."

We have merely attempted, in the foregoing notice of Dr. Jackson's treatise, to present to our readers a fair exposition of the author's views in relation to the functions of the spleen and placenta—and, as far as was practicable, in his own language. "Those views strike us as in the highest degree plausible—they are unquestionably of a most interesting character—and although the arguments by which the author has attempted to support their truth are in many particulars far from being conclusive, still the office he claims for both spleen and placenta may probably be found to be that which they actually fulfil—its admission is certainly attended with much fewer difficulties than attend the admission of any other, with the exception at least of that ascribed by Dr. Rush to the spleen—and nearly all the arguments which appear to establish the correctness of Dr. Rush's views, may also be adduced in support of the theory of Dr. Jackson.

In the conclusion of his essay Dr. J. remarks, that the views advanced by him as to the uses of the spleen and placenta, or rather of the two veins of which they are essentially the roots, originated in an investigation into the nature of *epilepsy*. "The great venous turgescence of countenance which occurs in the paroxysms of that disorder, and which turgescence is sometimes so excessive that the blood will exude through the pores of the skin like sweat, led him to infer that an epileptic seizure was owing to something or other preventing the ingress of blood into the heart by the superior cava. The effects produced by the experiments of tying the superior cava alone, and conjointly with the vena azygos, convinced him that such really was the case. The question as to the nature of the internal process which takes place in epilepsy then became definite—it was simply, how can the ingress of blood into the heart by the *superior* auricular opening be suddenly and temporarily prevented?—He thought by a sudden and temporary *rush* of blood into the heart by the *inferior* auricular opening. But what was to produce this rush of blood through their inferior auricular opening? There was nothing directly connected with the *inferior cava* which could produce it. Could it then be from the *cavæ hepaticæ*? It at once struck him that the *heart* had nothing to do with the propulsion of the portal blood through the liver: and that the *organ* with the *unknown function* produced the *disease* of the *unknown nature*."

D. F. C.

ART. XX.—*Fourth Annual Report of the Registrar-General, of the Births, Deaths, and Marriages, in England.* London, 1842, Oct.—362 pages.

THIS volume is made up with no less care than the preceding ones of the series, and the whole reflects great credit upon the government, for the enlightened policy which led to the establishment of a department for collecting and collating the most exact information in regard to the movements of population in England. Such works make us acquainted with the most interesting facts connected with the continued coming and going of a large mass of the human family peopling one of the most favoured spots in the world. They develop the effects of the agencies of civilization upon the human organization, and all the good and evil influences existing in country and town-life. They are therefore, of importance to the philosopher, philanthropist, and statesman, and not only of value at the present day, but as the means of making comparisons in ages to come.

In noticing the former reports,* we have condensed and extracted many of the most interesting results of the labours of the Registrar-General, and his assistants. The present volume treats of the marriages, births and deaths, as these

* See Nos. for January and July, 1841, and October, 1842.